Partnership Opportunity Document (POD)

for

NASA's Goddard Space Flight Center (GSFC)

Earth Venture Mission-2 Concept

Spacecraft, Launch, and On-Orbit Support

September 3, 2015

TABLE OF CONTENTS

SECTION **PAGE**

1.0 INTRODUCTION/SCOPE

This proposal opportunity is in response to the NASA Announcement of Opportunity (AO), Earth Venture Mission-2 (EVM-2) element of the Earth System Science Pathfinder (ESSP) Program, NNH15ZDA008J, which was released on September 3, 2015. NASA's GSFC is developing a mission concept to be proposed for this AO. The partnership opportunity is being issued to select a teaming partner to provide a spacecraft, instrument to spacecraft integration support, integration support for the spacecraft to launch vehicle, launch, and spacecraft operations.

The proposed mission is currently in pre-Phase A. This phase ends with a proposal that will be due 3 months after the AO is released. If the proposal is selected for implementation, the mission will proceed into Phase A, per NASA Procedural Requirement (NPR) 7120.5E. The following schedule should be used as a basis for responses to this opportunity:

Partnership Opportunity Document released	September 4, 2015
Responses due	September 17, 2015
Partner Selection announced	September 21, 2015
Proposal submittal in response to EVM-2 AO	September 3, 2015 + 3 months
Selection(s) Announced (target)	September 3, 2015 + 8 months
Initiate Investigation (target)	December 3, 2015 + 11 months
Launch Readiness date	NLT June 30, 2022, or 5 years after the contract is in place, whichever is earliest

1.1 COST

Total cost and cost fidelity are important issues for the mission trade studies. The cost cap for this AO is $166 million in Fiscal Year (FY) 2018 dollars. This cost includes the instrument, spacecraft, instrument to spacecraft integration support, integration support for the spacecraft to launch vehicle, launch, and spacecraft operations, as well as required contingency (25% or greater reserves on Phases A-D). Reserves will be held at the Project level, and not with the partner.

There will be no exchange of funds between the teaming partners for the portion of this partnership opportunity dealing with the preparation of the proposal to the EVM-2 AO. Funding will be available for subsequent phases should the candidate mission concept be competitively selected for those additional phases.

1.2 DESIRED MISSION SERVICES

NASA's GSFC is interested in formally establishing a partner to provide the following services for this mission: hosting of one instrument on a low Earth orbiting spacecraft, instrument to spacecraft integration support, spacecraft to launch vehicle integration support, launch, and spacecraft operations. The science instrument will be provided by NASA's GSFC for accommodation. The provision of a "delivery on orbit" arrangement for the observatory may be

proposed by the vendor, if it results in a significant reduction in overall cost for the mission. Inherent to such an approach shall be NASA's GSFC not taking title to the spacecraft until it has been deemed fully operational in its desired science orbit. The involvement of NASA's GSFC personnel and its NASA partners as it relates to the spacecraft and launch service provided shall be limited to insight only. NASA's GSFC and its NASA Agency partners shall not provide a final go or no-go decision on the launch of the observatory.

All interested parties are required to respond to this POD in accordance with Section 5 below.

1.3 PROPOSAL SUPPORT

It is expected that the selected POD respondent will provide support using their own resources to help develop the required EVM-2 proposal elements in response to the EVM-2 AO in the areas of a well-defined and documented spacecraft, instrument accommodations, instrument to spacecraft integration support, integration support for the spacecraft to launch vehicle, launch services, and spacecraft operations. This will involve meeting with the Principal Investigator (PI) and other proposal team members to help define the end-to-end performance requirements, including providing well-defined interfaces to the spacecraft in the form of Interface Control Documents (ICDs), to define the system architecture, to identify study topics, and to predict flight performance. This will include cost estimation for mission phases. The period of performance for this interval is expected to last approximately 3 months, starting in September 2015 with a proposal submission in December of 2015.

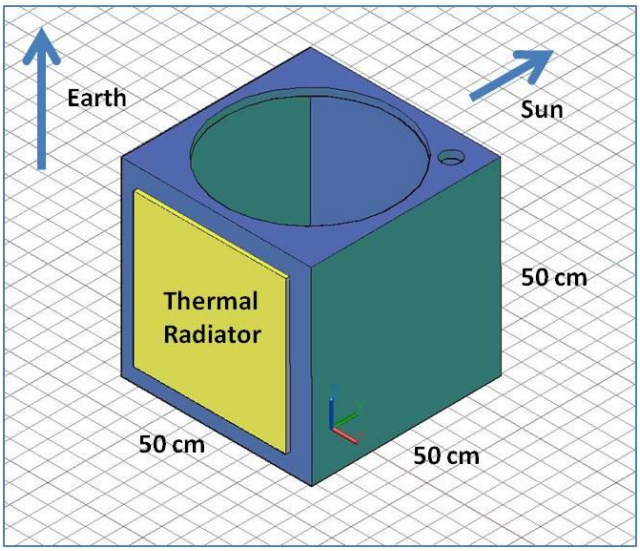
If the mission is selected for development and launch (Phases A-F), the partner will be responsible for the design and development of the spacecraft, instrument accommodations and integration support, integration support for the spacecraft to launch vehicle, launch, and spacecraft operations. The period of performance for this interval is expected to last approximately 5 years, starting late early 2017. These dates and times may change depending on selection timelines and budget allocations or phasing.

2.0 MISSION OVERVIEW

To meet the mission requirements, the spacecraft needs to have a minimum 24 month on-orbit design lifetime, with a desired 30 month lifetime.

The NASA's GSFC EVM-2 concept consists of a nadir-pointed instrument that shall be accommodated on a spacecraft launched into as low an orbit as possible, preferably not higher than 400 km but up to 450 km is acceptable. The orbit inclination should support instrument coverage over at least +/- 70 degrees of latitude, with higher latitude coverage desired but not required. The EVM-2 mission has a minimum 12 month on-orbit operating time, with a desired 24 month operating time

The preferred method of operation for the instrument is to upload a series of observation passes for the day and allow the instrument to operate by having the spacecraft turn power to the instrument on and off.



The concept will be managed by the NASA's GSFC in partnership with the chosen partner who will host the instrument on an existing spacecraft, which uses high-heritage subsystems and proven, well-tested engineering design. Proven launch-to-space heritage must be demonstrated in the submission in response to this POD. Mechanical, electrical, and thermal interfaces must be well defined by providing the NASA's GSFC EVM-2 team with draft ICDs–post partnership selection – that the NASA's GSFC EVM-2 team can use to show maturity of the EVM-2 design and design interfaces to the spacecraft and low risk of change or non-conformance. EVM-2 missions have been determined to be Category 3 missions (per NPR 7120.5E) with Class D payloads (per NPR 8705.4).

2.1 LAUNCH VEHICLE

The launch and related launch services are included in this partnership agreement, with NASA's GSFC's preferred arrangement being "delivery on orbit" of the spacecraft, if it carries a significant cost savings. The vendor is free to propose a partnering arrangement under which NASA's GSFC takes legal possession of the spacecraft prior to the vendor delivering the observatory (spacecraft with instrument) to the launch provider, post successful environmental testing. The partner must show heritage and previous launch success for the launch vehicle proposed to provide the delivery of the spacecraft to the orbit required. Any prior experience the partner has dealing with the launch service provider shall also be described. Launch loads and acoustic levels for the launch environment must be documented in a published User's Guide and shall be provided to NASA's GSFC.

Historic and predicted Rough Order of Magnitude (ROM) costs for launch of the proposed spacecraft on the proposed launch vehicle shall be provided in the response to this POD, as well as a letter(s) of partnership interest from the launch service provider(s).

2.2 LAUNCH MANIFEST

The vendor must commit to manifesting the NASA's GSFC EVM-2 on a spacecraft and launch vehicle in a timeframe commensurate with the requirements of the 2015 EVM-2 AO. The mission is required to be launch ready NLT June 30, 2022, or 5 years after the contract is in place, whichever is earliest. The ability to support earlier launch readiness dates are desired, if feasible. The vendor will also include costs associated with month-to-month delays in a launch date for up to 6 months.

3.0 TECHNICAL REQUIREMENTS

3.1 GENERAL

The EVM-2 mission will be designated a Class D mission.

The nadir-pointed instrument shall be accommodated on a spacecraft placed into as low of an Earth orbit as possible, preferably not higher than 400 km. The orbit inclination should support instrument coverage over at least +/- 70 degrees of latitude. The spacecraft must be of an End-of-Mission demisable design with re-entry less than 25 years after the end of the mission, or 30 years after launch, whichever is earlier.

The location and methodology for Observatory level Integration & Test (I&T), Mission Operations, and near real time transmission of instrument data to the GSFC shall be described in the response.

3.2 LIFETIME

The EVM-2 mission has a minimum 12 month on-orbit operating time, with a desired 24 month operating time.

Mechanical

3.2.1 Volume

The instrument is expected to fit within a volume of 0.5 m x 0.5 m x 0.5 m (0.13 m^3).

3.2.2 Mass

The EVM-2 concept instrument has a NTE mass of 38.5 kg.

3.3 POWER

The spacecraft shall provide NLT 250 W during instrument observation periods of at least two (2) minutes in duration per orbit (longer observation periods desired, if possible). More power/longer durations may be proposed as additional cost option(s). The power usage for the instrument will be about 15 W (TBR) during the remainder of the orbit. The spacecraft shall provide DC power between 28-32 V throughout the mission.

3.4 THERMAL

Thermal control will be a passive system with multi-layer insulation (MLI), radiators, and heaters.

3.5 DATA

The spacecraft shall provide a data interface to the instrument capable of both sending commands to the instrument and receiving data from the instrument. The preferred data

interface between the spacecraft and the instrument is not defined. Interfaces that can be supported by the spacecraft shall be described in the response to this POD.

The instrument's data rate is approximately 0.3 Mbps during the observation period and the data will need to be transmitted to GSFC for processing within 2 hours (preferably less) of each observation period. The data handling interface must support this rate.

3.6 ATTITUDE CONTROL

The spacecraft must support pointing the instrument to nadir +/- 5 degrees with pointing knowledge for the instrument to less than 1 km on the ground with an update rate of 10Hz.

Rotation of the instrument will need to be limited to keep the instrument's thermal radiator (located on one panel of the instrument) pointed away from the sun at all times while the instrument is in operation. The instrument aperture shall not be directly exposed to the sun.

The spacecraft should allow for the receipt of ground-based commands that orient the instrument to targets of opportunity (number TBD), while maintaining a minimum two (2) year lifetime.

4.0 STATEMENT OF WORK

During the proposal preparation period, the partner will participate as part of the mission proposal team. Statements of Work (SOWs) are not required to be submitted with the proposal. However, they are required before the Phase B work can begin. Therefore, the partner shall provide a draft statement of work during the proposal effort that defines general task statements for Phases B through F. SOWs will include the following as a minimum: Scope of Work, Deliverables (including science data), and Government Responsibilities (as applicable). SOWs need not be more than a few pages in length.

5.0 POD RESPONSE INSTRUCTIONS, FORMAT, AND SELECTION CRITERIA

5.1 INSTRUCTIONS

The respondent shall:

- Provide demonstrated flight heritage of the spacecraft and launch services.
- Demonstrate understanding and quantified experience in the design, fabrication, integration, and testing of the spacecraft system proposed. The response shall describe how the proposed spacecraft and launch services.
- Provide well-defined spacecraft engineering drawings for mechanical, thermal, and electrical interfaces. Describe the spacecraft and define the spacecraft to instrument interfaces. Provide information on the maturity of these interfaces and indicate if the latest configuration has flight heritage and demonstrated on-orbit performance.
- Describe spacecraft capabilities as they apply to the requirements given in Section 3.
- Provide the on-orbit consecutive life-time capability of the proposed spacecraft (planned and demonstrated).
- Identify the technical maturity/qualification of the proposed spacecraft and operations concept. If the spacecraft has not already demonstrated the required mission life, the respondent shall describe how these items will be demonstrated, including a timeline for this demonstration. This qualification will not be funded under this effort.
- Describe the approach for supporting the proposal and the mission development, including the level of support that the partner plans to make available for each activity and the names of those individuals who will actively participate in the writing of the proposal.
- Provide a brief statement of work defining participation in the proposal.
- Provide an estimated cost from initial selection (Phase A) onward for the all spacecraft activities including mission design, integration and testing, launch services, and

spacecraft operations. The response shall include a brief discussion of the uncertainty in the cost estimate.

5.2 FORMAT

The response to this partnership opportunity is limited to 20 slides. Excluded from the page count are the cover letter, title pages, table of contents, and acronym list. Partners may attach additional appendices that further describe their capabilities, although GSFC is under no obligation to include the contents of such appendices in the evaluation of the offer package.

The entire offer package, including any cover letter, title pages, and other supporting material, shall be formatted as a Portable Document Format (PDF) file delivered to the E-mail address below.

6.0 EVALUATION FACTORS AND CRITERIA

The evaluation team will use the following factors in selection and award:

1. Technical Approach (35%). Offerors will be evaluated on their ability to meet the instrument technical requirements given in Section 3. This includes demonstrated understanding of the requirements and proposed approach to meet those requirements.

2. Cost (30%). Offerors will be evaluated on their overall cost and on the reasonableness of cost and schedule estimates.

3. Relevant Experience and Past Performance (35%). Special emphasis will be given to demonstrated experience with similar missions.

7.0 POINT OF CONTACT:

Questions about this POD should be directed to William Cutlip (Phone: 301-286-0438, Email: william.e.cutlip@nasa.gov).

8.0 FINAL DUE DATE OF POD RESPONSE

The response to the POD is due no later than 5 p.m. EDT on September 17, 2015. The electronic PDF document shall be sent to William Cutlip (Email: william.e.cutlip@nasa.gov)

It is the responsibility of potential respondents to monitor the NASA Acquisition Internet Service (NAIS), GSFC Procurement Site

http://code210.gsfc.nasa.gov/podhome.htm

for information concerning this POD.

9.0 ACRONYMS

AO	Announcement of Opportunity
CBE	Current Best Estimate
DC	Direct Current
ESSP	Earth System Science Pathfinder
EVM	Earth Venture Mission
FY	Fiscal Year
GSFC	Goddard Space Flight Center
I & T	Integration & Test
ICD	Interface Control Document
MLI	Multi-Layer Insulation
NASA	National Aeronautics and Space Administration
NLT	No Later Than
NPR	NASA Procedural Requirement
NTE	Not To Exceed
PDF	Portable Document Format
PI	Principal Investigator
POD	Partnership Opportunity Document
ROM	Rough Order of Magnitude
SOW	Statement of Work
TBD	To Be Determined
U.S.A	United States of America